VI.8 Evaluation of Integrated Hydrogen Systems

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Objectives

- Oversee international working group to address hydrogen technology integration
- Establish database of international hydrogen development activities
- Evaluate integrated hydrogen systems for performance and permitting policies

Technical Barriers

This project addresses the following technical barriers from the Codes and Standards and Safety sections of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- I. Strategic Conflicts between Domestic and International Standards Objectives
- A. Limited Historical Database for Components
- B. Access to Industry Proprietary Data
- D. Technical and Scientific Understanding of Systems Limits the Value of Protocols

Approach

- Organize working groups for International Energy Agency (IEA) Hydrogen Task 18, plan tasks and meetings.
- Identify information sets and collect data for assessment.
- Evaluate integrated demonstration systems for performance and application of codes and standards.
- Summarize lessons learned.

Accomplishments

- Following Task Definition Workshop in June 2003, developed IEA Task 18 framework for executive committee approval in October 2003.
- Established two Task 18 working groups and held international kick-off meeting in Las Vegas, Nevada in March 2004.
- Established structure for international database task, including participation in collaborative hydrogen resources study.
- Identified nine projects for evaluation and began data collection and modeling efforts.
- Established two websites for working group members, including secure site for data analysis.
- Participated in executive committee meeting in April 2004, including presentation of annual report and recruitment of new member countries.

Future Directions

- Task 18 is scheduled to continue through December 2006. Meetings will be held semi-annually, fall and spring.
- Establish information database by fall 2004 and update annually
- Participate in collaborative international Hydrogen Resources Study
- Continue case studies of demonstration systems, with emphasis on application of Codes and Standards
- Complete analysis of Spanish Fuel cell Innovative Remote Systems for Telecommunications (FIRST) system and summarize results by end of 2004
- Participate in IEA Executive Committee activities, including semi-annual reporting

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Introduction

This project brings together an international collaboration under the auspices of the International Energy Agency. The activity is titled Evaluation of Integrated Hydrogen System; and it is Task 18 under the Hydrogen Implementing Agreement (HIA). The objective of the task is to learn from and apply practical lessons to integrated hydrogen demonstration systems. The gathering and dissemination of lessons learned from on-going hydrogen activities is essential to the future success of hydrogen systems. This is true for technology maturation and for harmonizing safety codes and standards as well. As of June 2004, there are 10 international members of Task 18.

Approach

Under this project there are two major activities or subtasks. The first is a general gathering of information and data on hydrogen technologies and prospects worldwide. This includes archiving of significant studies, collection and analysis of resource and utilization data, and assessment of case studies, including an overview of codes and standards applied to demonstration systems. An international collaborative study of hydrogen resources is being supported under the first subtask. Participants contribute data via a secure website.

The second subtask is a more detailed analysis of on-going demonstration projects in participating countries. The analysis uses sophisticated modeling tools to evaluate component and/or system performance. Energy efficiency, environmental performance and cost are all being evaluated, along with the impacts of safety procedures and codes and standards requirements. Participants work through an on-line project room. Intellectual property and proprietary data are protected within this subtask. Reporting protocols for summary reports are being developed.

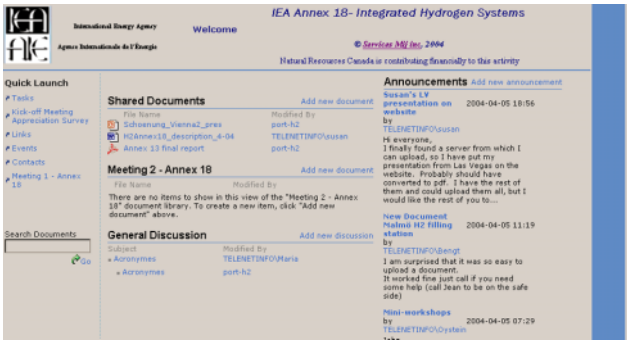

Figure 1. Welcome Page of the Public Website

Results

Since our kick-off meeting in March 2004, we have made significant progress in establishing international cooperation and participation in this evaluation effort. Ten countries are now members of Task 18: Canada, France, Iceland, Italy, Japan, Norway, Spain, Sweden, United Kingdom, and the U.S. A number of others have expressed interest. The welcome page for the public website (http://www.port-h2.com/IEA-Annex-18/) is shown in Figure 1. A structure has been defined for the database task, with archiving initiated on a secure web site. A commitment has been made for collaboration on the hydrogen resources study. Several new case studies hosted by the Hydrogen, Fuel Cells and Infrastructure Technologies Program at http://www.eere.energy.gov/hydrogenandfuelcels/hydrogen/iea/case-studies.html have been completed.

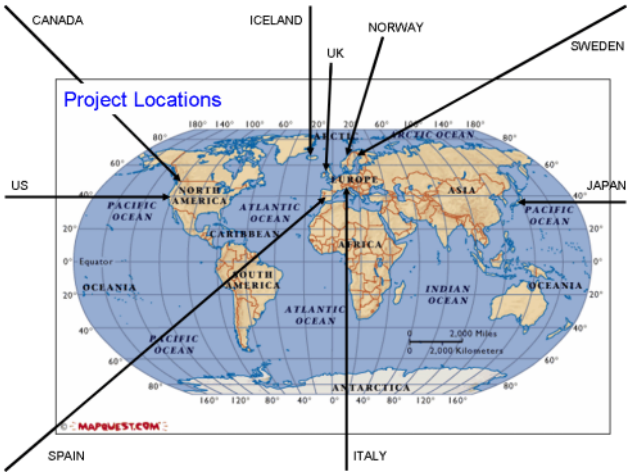

Figure 2. Locations of Demonstration Projects Identified for Evaluation

The demonstration evaluation team has identified at least 9 demonstration projects for detailed analysis. These include:

- **Spain**: FIRST project will be the first system analyzed. Later possibilities include the Renewable Energy Systems and Hydrogen Wind/electrolysis systems in Canary Islands, or Greece.
- **Sweden**: Malmö filling station and hythane-fueled buses.
- **Iceland**: hydrogen bus/refueling project, the Ecological City Transport System.
- **Japan**: National Institute of Advanced Industrial Science and Technology laboratory demo of regenerative fuel cell system
- **U.S.**: Las Vegas Energy Station, which includes a small steam methane reformer fueling a stationary fuel cell power plant and city buses.
- **Canada**: Hydrogen Refueling Station – University of British Columbia in Vancouver
- **UK**: Promoting Unst Renewable Energy project – a stand-alone island system – and the Hunterston Hydrogen project in Scotland, for which a large-scale wind-hydrogen system is proposed.
- **Italy**: Milan fuel cell power plant and bus refueling station.

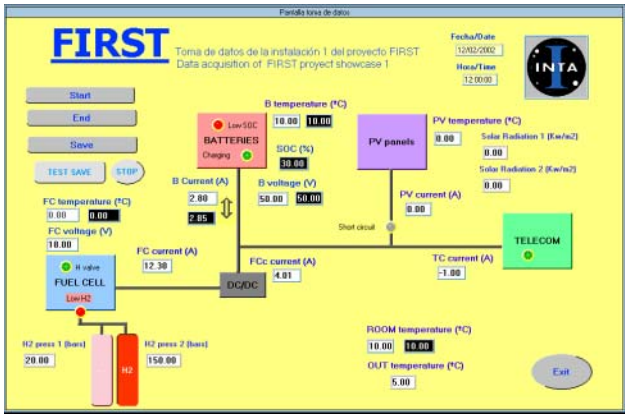

Figure 3. FIRST Project in Spain

The map in Figure 2 indicates the location of candidate projects.

The FIRST project in Madrid is in a stage of initial detailed analysis. A key feature of the FIRST project is the real-time data collection site, pictured in Figure 3. Summary results are expected by the end of 2004.

Conclusions

- There is significant international interest in the IEA Integrated Systems Evaluation Task 18.
- Internet-based communications, archiving, and project room analysis are providing our primary work environment.
- Major contributions to international efforts to understand and develop hydrogen systems are anticipated, with specific focus on the variability of codes and standards worldwide

References

1. "Annex 18 – Integrated Systems Evaluation" framework document; April 2004 revision; submitted to IEA headquarters

FY 2004 Publications/Presentations

1. Schoenung, Susan M., "Evaluation of Hydrogen Integrated Systems Modeling and Analysis for the International Energy Agency", presented at the 15th Annual U.S. Hydrogen Conference and Hydrogen Expo USA, Los Angeles, April 27, 2004.

2. Dubé, Jean and Schoenung, Susan, "International Energy Agency Hydrogen Implementing Agreement Task 18 – Integrated Systems Evaluation" presented at the Windsor Workshop, June16, 2004.

3. Schoenung, Susan "Annex 18 – Evaluation of Hydrogen Integrated Systems" white paper, available at http://www.port-h2.com/IEA-Annex-18/.

4. Schoenung, Susan "Annex 18, Evaluation of Integrated Systems," Semi-annual report to ExCo, October 2003.

5. Schoenung, Susan, "Annex 18, Evaluation of Integrated Systems," 2003 Annual report to ExCo, January 2004.

6. Schoenung, Susan, "Annex 18, Evaluation of Integrated Systems," Semi-annual report to ExCo, March 2004.

7. Schoenung, Susan, "Annex 18, Evaluation of Integrated Systems," Presentation to joint meeting of IEA Fuel Cells Implementing Agreement and Hydrogen Implementing Agreement, Vienna, April 2004.